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09/884,207	06/19/2001	Hiroshi Oinoue	450100-03290	3791

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EXAMINER	
GRAHAM, ANDREW R	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/884,207	Applicant(s) OINOUE ET AL.	
	Examiner Andrew Graham	Art Unit 2644	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 July 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-5* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-5* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1 and 3-5 have been considered but they are not persuasive.

On page 9, lines 1-4, the applicant has stated, "The content described in column 9, lines 3-5 of Kunugui is 'withing (sic) the frequency range higher than the cutoff frequency of Fo of 2KHz for instance, the sound reflection factor has a tendency of decreasing' and cutoff frequency Fo of the low pass filter (3-13) is not selected by 2KHz". To paraphrase, the examiner interprets this statement by the applicant to suggest that the cutoff frequency of filter 3-13 is not 2 KHz. The examiner respectfully disagrees. A low pass filter, as is well known in the art, comprises a cutoff or corner frequency as a defining part of its frequency characteristic. The "cutoff frequency Fo" in column 9, lines 3-5 is referenced in the context of the "operation of the sound field correcting system of Figure 12" (col. 9, lines 1-2). The reflected sound wave has an amplitude characteristic given by the equation in col. 9, line 10, wherein the cutoff frequency variable Fo is part of the equation. Col. 9, lines 15-18 state that the LPF 3-13 implements this transfer characteristic G and col. 10, lines 22-25 states that the frequency characteristic of the LPF is determined by the frequency characteristic of the reflected wave. Thus, even if the value of the cutoff frequency intrinsic to the low pass filter 3-13 is not independently selected by the low pass filter (but rather, is chosen in response to the characteristic of the

reflected wave), the LPF yet implements a matching frequency response that includes such a cutoff frequency of Fo, which in the example given, is 2KHz. Please also consider, as context, the particular wording regarding the similar embodiment of Figure 9, noting that the HPF 2-9 also implements a level characteristic G (col. 7, lines 57-62). In this instance, Kunugi clearly teaches that the cutoff frequency of the transfer characteristic G is the cutoff frequency of the HPF filter (col. 8, lines 47-50). Contextually, this same relationship (that the cutoff frequency Fo of the transfer characteristic G is a property of the LPF 3-13, as part of the implementation of G by the LPF 3-13) is understood to be present in the configuration shown in Figure 12, and thus the teachings of Kunugi read on "a cutoff frequency of the low pass filter means is selected to be not lower than 2kHz and not higher than 6kHz".

On page 9, lines 5-8, the applicant has stated, "The difference sound field doesn't similarly become the output frequency response of the present application in Figure 10 of Kunugi". The examiner respectfully notes, however, that an exact equality between Figure 10 of Kunugi and the frequency response of the applicant's invention was not drawn in the previous office action. As Figure 10 relates to Figure 9 of Kunugi, the resulting sound field of Figure 10 is considered analogous (even if not identical) to the sound field produced in the present application, as is shown in Figure 4 of the present application. Figure 10 of Kunugi illustrates that the frequency range passed by the high pass filter of Figure 9 is reduced

in the final output frequency response, lower than the frequency range not passed by the filter. Similarly, Figure 4 of the present application illustrates that the frequency range passed by the low pass filter (23,27) is reduced or comparatively lower than frequency range not passed by the filters in the final output frequency response of the system. Figure 12 of Kunugi utilizes a low pass filter in the parallel signal processing path. By passing high/low ranges in an opposite manner (low pass rather than high pass, as compared to Figure 9), the system of Figure 12 of Kunugi would have provided a boost to the high frequency level of the signal output by the system, paralleling that shown in Figure 4 of the present application. The components of Figure 12 were explicitly relied upon in the rejections previous office action, as is repeated herein below.

In the remaining passages of page 9, the applicant submits that the same issue addressed above is not taught or suggested by Klayman and that the dependent claims are believed patentable at least for the same reasons as the independent claim. In light of the above response, the issue regarding Klayman has been addressed by the teachings of Kunugi and the rejections of the dependent claims have been reviewed and are respectively maintained herein.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. **Claims 1 and 3** are rejected under 35 U.S.C. 103(a) as being unpatentable over Kunugi et al (USPN 4980914) in view of Klayman et al (USPN 5850453) and Blachot (USPN 4438414). Hereafter, "Kunugi et al" will be referred to as "Kunugi" and "Klayman et al" will be referred to as "Klayman".

Kunugi teaches a sound field correction device for use in a vehicle, wherein the correction comprises an audio signal output with a substantially flat frequency characteristic.

Specifically, regarding **Claim 1**, Kunugi teaches:

An acoustic apparatus ("sound field correcting system") (col. 8, lines 63-65) comprising,

attenuator means (3-2) for attenuating a first audio signal supplied thereto to produce a second audio signal (col. 9, lines 19-21)

low pass filter means (3-13) for reducing high frequency components (col. 9, lines 15-19)

speaker (for example, 1-5) means supplied with the fourth audio signal obtained from the differential amplifier means (col. 1, lines 34-37; col. 9, lines 41-42),

wherein a cutoff frequency of the low pass filter (3-13) means is selected to be not lower than 2kHz and not higher than 6kHz ("2KHz"; col. 9, lines 3-5)

It is further noted that the inverter (3-3) in combination with the adder (3-4) shown in Figure 12 perform the equivalent function of

the claimed "differential amplifier means", wherein the "first signal" is the input signal to Figure 12 and the input to the level adjusting means is a delayed version of the same first signal. The result of the processing in the parallel path of the systems of Kunugi, wherein the processing includes the level adjustment performed by (3-2), is that the composite frequency characteristic received at the listening point is essentially flat (col. 3, lines 42-56). Figure 10 illustrates an effect of one embodiment of the system, wherein it can be seen that the low frequency sound pressure level has been increased relative to higher frequency sound pressure levels (col. 8, lines 36-38). Kunugi specifies that one area of application as being a vehicle (col. 7, lines 21-25).

Though Kunugi discloses components included in the limitation, Kunugi does not clearly specify:

- differential amplifier means operative to produce a fourth audio signal corresponding to a difference between the first and third audio signals supplied thereto, and
- that the attenuation of the audio signal into the attenuator means (3-2) of Kunugi is adjusted by the attenuator means (3-2) that a listener who intends to listen to reproduced sound obtained from the speaker means is able to recognize a virtual sound source position in front of and at a level higher than an actual position of the speaker portion.

Klayman discloses a sound field correction system for a vehicle.

Specifically regarding **Claim 1**, Klayman teaches:

differential amplifier means (difference amplifier, 504, Figure 11) operative to produce a fourth audio signal (output) corresponding to a difference between the first and third audio signals (two input signals, in view of inputs to inverter and adder of Kunugi) supplied thereto (col. 20, lines 41-43, in view of the difference signal determined by the inverter (3-3) and adder (3-4) of Figure 12 of Kunugi)

that the attenuation of the audio signal into the attenuator means (input to 296, Figure 9) is adjusted by the attenuator means (296, Figure 9) that a listener (such as a forward section occupant (48)) who intends to listen to reproduced sound obtained from the speaker means (46, in view of loudspeaker of Kunugi) is able to recognize a virtual sound source position in front of ("directly in front") and at a level higher than an actual position of the speaker portion ("ear level" versus "near the legs or feet").

It is particularly noted that the "directly in front" and "ear level" signal source location is taught by Klayman as corresponding to a relatively constant sound pressure level for all frequency levels (col. 6, lines 22-24)

To one of ordinary skill in the art at the time the invention was made, it would have been obvious to implement the inverter and adder of Kunugi through the use of a difference amplifier, as is taught in the forming of a difference signal in the circuit diagrams of Klayman.

The motivation behind such a modification would have been that such a difference amplifier would have produced the same output signal using a single amplifier to perform the two functions of inversion and addition, as is performed in the system of Klayman, rather than the implementation of separate components to execute the separate functions. To one of ordinary skill in the art at the time the invention was made, it would have been obvious to influence the level adjustment circuit (3-2) of Kunugi at least partially with the intention of generating a spatially corrected virtual speaker placement in a vehicle environment, as is similarly performed for the level adjusting resistor (296) of Klayman (col. 16, lines 25-27). The motivation behind such a modification would have been that such gain processing would have provided the user in Kunugi with a desired, flat local frequency response with speakers placed at acoustically-undesirable locations. Such correction for acoustically-undesirable would have enabled the speakers in a vehicle to meet ergonomic requirements, as is taught by Klayman. As is noted above relevant to both disclosures, both systems of Kunugi and Klayman provide flat frequency responses to a user from vehicle speakers. The particular low frequency reduction provided by the circuit of Figure 12 of Kunugi would have been able, under the scheme of control of Klayman, to provide a correction for the overall frequency characteristic of the output signal, such as shown in Figure 6a for correcting the characteristic of Figure 4B of Klayman.

However, Kunugi in view of Klayman do not specify:

- that the low pass filter receives the output signal of the attenuator

However, such an reversed serial arrangement was known in the art at the time of the invention. Blachot teaches a tone control circuit that comprises parallel signal paths, wherein at least one of the paths includes a potentiometer for level control and a low pass filter.

Specifically regarding **Claim 1**, Blachot teaches:

- that the low pass filter (4) receives the output signal of the attenuator (7)(Figure 2, col. 1, lines 46-62 in view of level adjustment and low pass components of Kunugi)

To one of ordinary skill in the art at the time the invention was made, it would have been obvious to implement the level adjustment means of Kunugi in view of Klayman before the low pass filter, as is disclosed by Blachot. The motivation behind such a modification would have been that such sequential placement would have enabled noise caused by the level adjusting components in the band above the corner frequency of the filter to be rejected by the filter.

Regarding **Claim 3**, the disclosed embodiment of Klayman includes separate improvement means for each of a left and right input signal (col. 14, lines 33-43). The system of Kunugi involves an embodiment, shown in Figure 21, wherein each output channel includes a correction circuit (6-11) that can be seen to include level adjusting means. The variable resistors (252,296) of Klayman and the components of the

individual correcting circuits of Kunugi read on "said attenuator means is provided for attenuating each of left and right channel signals forming a stereo audio signal" (col. 15, lines 7-13 and 65-67 of Klayman). The low pass filter of Kunugi, in view of these two signal paths, reads on "low pass filter means is provided for reducing high frequency components of each of the attenuated left and right channel signals" (col. 9, lines 15-18). The inverter (3-3) and adder (3-4) of Kunugi in view of the differential amplifiers (502,504) of Klayman, read on "said differential amplifier means is provided to be operative to produce" a "left channel difference signal" and a "right channel difference signal". The connections on Klayman of the Left Out and Right Out signals to the automobile speakers (46), read on "speaker means is provided to include a left speaker supplied with the left channel difference signal" and "a right speaker supplied with the right channel difference signal" (col. 5, lines 54-61). The desired response curve, in view of the two arrows shown in the system of Figure 2 of Klayman that represent a pair of ideal speakers placed directly in front of a user at approximately ear level, reads on "attenuation of the left channel signal and attenuation of the right channel signal in the attenuator means are so selected that the listener is able to recognize a virtual left sound source position in front of and at a level higher than an actual position of the left speaker and recognize a virtual right sound source position in front of and at a level higher than an actual position of the right speaker" (col. 6, lines 24-27 and 32-37).

3. **Claims 4 and 5** are rejected under 35 U.S.C. 103 (a) as being unpatentable over Kunugi in view of Klayman and Blachot as applied above, and in further view of Kurisu (USPN 6108430).

As detailed above, Kunugi teaches a sound field correction device for use in a vehicle, wherein the correction comprises an audio signal output with a substantially flat frequency characteristic. Klayman discloses circuitry for the virtual positioning of a sound signal source. Blachot teaches a tone control circuit that comprises parallel signal paths, wherein at least one of the paths includes a potentiometer for level control and a low pass filter.

However, Kunugi considered in view of Klayman and Blachot does not specify:

- equations to be satisfied by the signal processing for two virtual left and right signals of:

$SLO=(L\times ARR(z)-R\times ARL(z))/(ALL(z)\times ARR(z)-ALR(z)\times ARL(z))$

$SRO=(R\times ALL(z)-L\times ALR(z))/(ALL(z)\times ARR(z)-ALR(z)\times ARL(z))$

$L=SL\times BLL(z)+SR\times BRL(z)$

$R=SL\times BLR(z)+SR\times BRR(z)$

wherein

SLO represents the amplified left channel difference signal,

SRO represents the amplified right channel difference signal,

SL represents the left channel signal,

SR represents the right channel signal,

ALL(z) represents an acoustic transfer function from the left speaker to a left ear of the listener,

ALR(z) represents an acoustic transfer function from the left speaker to a right ear of the listener,

ARL(z) represents an acoustic transfer function from the right speaker to the left ear of the listener,

ARR(z) represents an acoustic transfer function from the right speaker to the right ear of the listener,

BLL(z) represents an acoustic transfer function from the virtual left sound source position to the left ear of the listener,

BLR(z) represents an acoustic transfer function from the virtual left sound source position to the right ear of the listener,

BRL(z) represents an acoustic transfer function from the virtual right sound source position to the left ear of the listener, and

BRR(z) represents an acoustic transfer function from the virtual right sound source position to the right ear of the listener.

However, Kurisu teaches the equations for a general virtual sound source. Figure 2 illustrates a general arrangement of two real speakers (SP_L, SP_R) which output signal that form the virtual speaker (SP_x) (col. 4, lines 16-20). The shown equations are

HLL: transfer function starting from the sound source SPL and reaching the left ear of the listener M;
HLR: transfer function starting from the sound source SPL and reaching the right ear of the listener M;
HRL: transfer function starting from the sound source SPR and reaching the left ear of the listener M;
HRR: transfer function starting from the sound source SPR and reaching the right ear of the listener M;
HXL: transfer function starting from the sound source SPX and reaching the left ear of the listener M;
HXR: transfer function starting from the sound source SPX and reaching the right ear of the listener M;
the sound sources SPL and SPR can be expressed by

$$SPL\ (HXL\times HRR-HXR\times HRL)/(HLL\times HRR-HLR\times HRL)\times SPX \quad (1)$$

$$SPR\ (HXR\times HLL-HXL\times HLR)/(HLL\times HRR-HLR\times HRL)\times SPX \quad (2)$$

A correspondence can be seen between (ALL(z) and HLL), (ALR(z) and HLR), (ARL(z) and HRL), (ARR(z) and HRR), (BLL(z) and HXL), (BLR(z) and HXR), (BRL(z) and HXL), and (BRR(z) and HXR). Figure 2 only illustrates a single virtual speaker. The sound from two audio sources would inherently be the summation of the two transfer functions from the first source to the ears of a listener and from the second source to the ears of a listener. Accordingly, correspondence can also be seen between $(HXL\times HRR-HXR\times HRL)/(HLL\times HRR-HLR\times HRL)$ and

$SLO=(L\times ARR(z)-R\times ARL(z))/(ALL(z)\times ARR(z)-ALR(z)\times ARL(z))$. $L=SL\times BLL(z)+SR\times BRL(z)$ $R=SL\times BLR(z)+SR\times BRR(z)$ for just a left speaker a equals L=SL x BLL(z) and R=SL x BLR(z). Applied to the other formula $SLO=(L\times ARR(z)-R\times ARL(z))/(ALL(z)\times ARR(z)-ALR(z)\times ARL(z))$, this formula becomes

$SLO=(SL\times BLL(z)\times ARR(z)-SL\times BLR(z)\times ARL(z))/(ALL(z)\times ARR(z)-ALR(z)\times ARL(z))$, which can be rewritten as

$SLO=(SL)(BLL(z)\times ARR(z)-BLR(z)\times ARL(z))/(ALL(z)\times ARR(z)-ALR(z)\times ARL(z))$ which matches the formula

given by Kurisu of $(HXL \times HRR - HXR \times HRL)/(HLL \times HRR - HLR \times HRL) \times SPX$, noting that the condition of SR=0 and SL=SPX was applied. Two virtual speakers are again, the addition of another copy of this equation for a second sound source. Thus, the descriptive formula taught by Kurisu reads on the equations given in Claim 4.

To one of ordinary skill in the art at the time the invention was made, it would have been obvious to utilize the equation of Kurisu on determining the operation of the positioning of the two ideal speakers of the system of Kunugi in view of Klayman and Blachot. The motivation behind such a modification would have been that the application of such an equation would have enabled the virtual positioning of the sound sources at an arbitrary location outside the head, and not just in front of a user. Figure 2 of Kurisu illustrates the positioning of a speaker behind a user.

Regarding **Claim 5**, Klayman teaches that the relative signal levels of the frequency component affect the perceived height or elevation of a signal source. Klayman also discloses the use of a variable resistance for increasing or decreasing a respective signal level (col. 6, lines 18-31)). The variable aspect of these attenuators, in view of the teachings of Klayman, reads on "constituted with a variable attenuator by which the attenuation of the first audio signal is varied and said virtual sound source position is adjusted by changing the attenuation of the first audio signal". The left and right correction circuits of Klayman being paired with the left and right input signals, respectively, reads on

"said virtual left sound source position is varied by changing the attenuation of the left channel signal and said virtual right sound source position is varied by changing the attenuation of the right channel signal".

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew Graham whose telephone number is 571-272-7517. The examiner can normally be reached on Monday-Friday, 8:30 AM to 5:00 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vivian Chin can be reached at 571-272-7848.

The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AG
Andrew Graham
Examiner
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ag
September 15, 2005

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